

**A Rustle in the
Paddy Field
Snakebite as an
Occupational Disease of
Poor Rural Workers in Asia**

Prof. Julian White AM

**Toxinology Department
Women's & Children's Hospital
North Adelaide, Australia**

Extent of the Snakebite Problem

- **Should we be worried about snakebite?**
- Approximately 2.5 to 5 million venomous snakebites occur globally every year
- More than 100,000 people die from snakebite every year
 - Some experts estimate up to 200,000 deaths/yr
 - In India alone >45,000 die annually
- About 400,000 people require amputations following snakebite annually
- **Snakebite is the most neglected of all neglected tropical diseases**





World Health Organisation

- **Several years ago WHO finally agreed to add snakebite to it's list of Neglected Tropical Diseases**
- A few years later it removed it from the list, demoting it other tropical diseases of lesser importance
- **Why?**
 - Because powerful lobby groups with money wanted to ensure resources for their issues were not diluted
 - They pointed to the relatively patchy data on snakebite
- **Hope on the horizon**
 - In 9 days time the full WHO Assembly will devote time to considering the snakebite problem, with many countries, led by Costa Rica, promoting this debate



Who is at risk of snakebite?

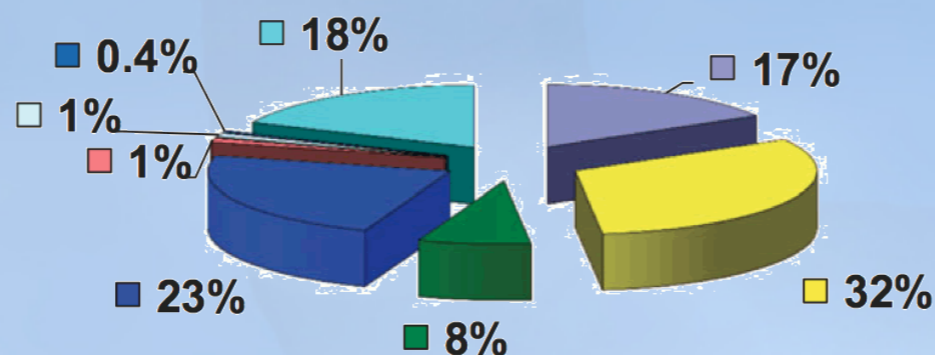
- Almost everyone
- Particular risk groups include
 - Rural workers
 - Poor people especially in the rural tropics
 - Remote area workers (mining, petroleum etc industries)
 - People working with snakes/venoms
 - Military personnel
- **Snakebite is, overwhelmingly, an occupational disease**





Snakebite as an Occupational Disease

- Some comparisons
 - Asbestos-related diseases cause ~ 100,000 deaths/yr globally
 - Work-related accidents and diseases cause ~ 2.3 million deaths/yr



- Communicable diseases
- Respiratory Diseases
- Mental Disorders
- Genitourinary system
- Cancer
- Circulatory diseases
- Digestive system diseases
- Accidents and violence

- Snakebite kills >100,000/yr, most likely >150,000
- May account for equivalent of 5% of all work-related deaths



Snakebite as a Poverty Trap

- **Snakebite in a poor rural community**
 - The person bitten most often is a productive worker, supporting their family & community
 - The patient will often need to seek medical care remote from their home/work
- **Economic costs**
 - Cost of transport to hospital
 - Cost of lost earning capacity/time
 - Cost of relatives accompanying to provide in-hospital care
 - Cost of lost earning capacity/time for relatives
- **Example**
 - In Myanmar commonly total cost exceeds total family income for 1 year!
 - This condemns family to years of poverty





Tackling the Snakebite Problem

- **Prevention**
- Arguably the most cost effective response
- Community education
 - Make clear the potentially severe consequences of snakebite
 - Death or permanent injury
 - Economic cost
 - Avoid risky behaviour
 - Reduce likelihood of snake encounters
 - Reduce attractants for snakes in areas people frequent
 - Training on how to respond if snakes are found in areas people frequent
- Identify, train and support local “champions” of prevention strategies



Tackling the Snakebite Problem

- **Prevention**
 - Education of specific at-risk groups
 - Make clear the potentially severe consequences of snakebite
 - Death or permanent injury
 - Economic cost
 - Use of appropriate PPD
 - Avoid risky behaviour
 - Reduce likelihood of snake encounters
 - Reduce attractants for snakes in work areas
 - Training on how to respond if snakes are found in work areas
 - Identify, train and support local “champions” of prevention strategies within the workforce
 - May include training on snake removal



Tackling the Snakebite Problem

- **Treatment**
 - Ensure health staff at all levels are trained in snakebite management
 - Efficient provision of effective care
 - Provide appropriate resources where most needed
 - Antivenom etc at smaller hospitals to allow short bite-to-needle time
 - Appropriately trained staff
 - Ensure antivenom is
 - Appropriate for snake fauna
 - Both safe and effective
 - Affordable



Tackling the Snakebite Problem

- **The realities of snakebite**
 - Health resources are often poor or non-existent in areas of most need
 - Rural communities have little trust in health systems and so use traditional healers
 - TDs provide useless or dangerous treatment and delay reaching definitive care
 - Antivenom is often unavailable, or of poor quality, or is too expensive
 - Corruption allows distribution of inappropriate antivenoms
 - Health staff often untrained in snakebite and afraid to use antivenom even when available





Table with multiple columns and rows, likely a schedule or data table. The text is small and difficult to read, but it appears to be a structured list of information.



Several people are standing in the center of the room, looking at a large display board or table. They appear to be engaged in a discussion or presentation. The people are dressed in casual to semi-formal attire.



Tackling the Snakebite Problem

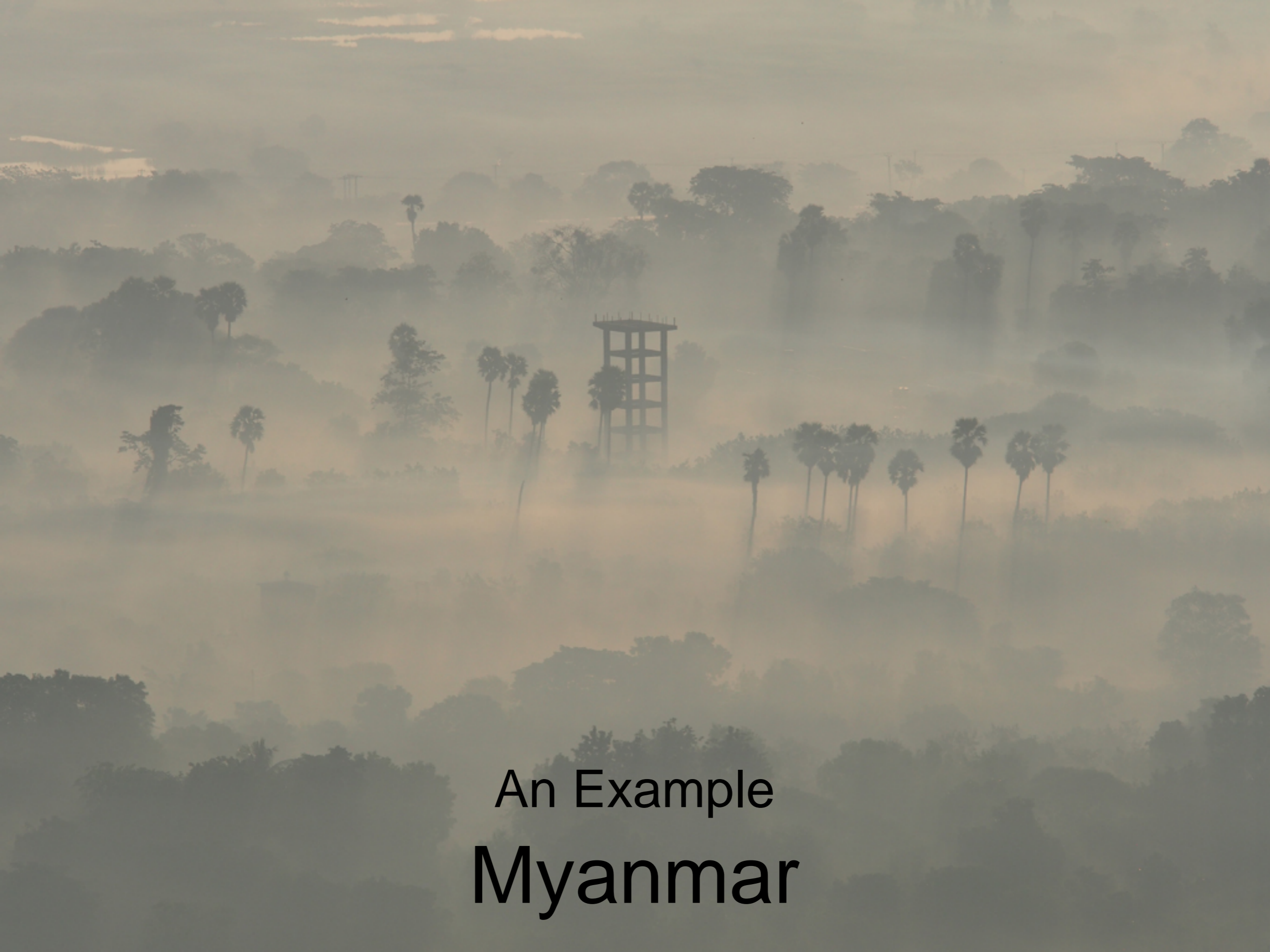
- **Define the extent of the problem**
 - Statistics on snakebite and other forms of envenoming are often lacking
 - Hospital data accounts for only a small fraction of the actual disease burden for snakebite
 - The Indian million death study dramatically illustrates this
 - There is an urgent need to accurately document the true disease burden
 - Delineating the problem will allow appropriate resource allocation



Tackling the Snakebite Problem

- **What about foreign workers sent to snakebite-prone areas?**
- Need to define the nature of the risk
 - Local snake fauna
 - Likely mechanisms of bites - develop prevention strategies
 - Available health resources locally if a worker is bitten
 - Develop a clear clinical response pathway before deployment of personnel and provide required resources (antivenom etc)
- **How to achieve this?**
 - Engage a clinical toxinology expert





An Example
Myanmar

Myanmar Snakebite Project

- Myanmar (Burma)
- A poor, backward, SE Asian nation of ~ 55 M people, covering diverse ethnic groups
- A vibrant venomous snake fauna, notably
 - Vipers: Russell's viper, green pit vipers
 - Elapids: cobras, kraits, king cobras, sea snakes
- An historic snakebite problem
 - Snakebite has been amongst the top 10 causes of death
 - Officially at least 14,000 cases & >1,000 deaths/yr
 - Estimate of ~ 80,000 cases & >2,000 deaths/yr
 - Snakebite causes >70% of all cases of AKI and these have ~ 30+% mortality rate
- Myanmar has long produced it's own antivenom
 - Recent problems with production resulted in importation of Indian AV











Russell's viper - *Daboia siamensis*



Monocellate cobra - *Naja kaouthia*



Green pit viper - *Trimeresurus albolabris*



Malayan krait - *Bungarus candidus*

Myanmar Snakebite Project

- What clinical problems does snakebite cause?
- Current information suggests
 - Russell's viper - coagulopathy, kidney failure, skin damage, shock, Sheehan's syndrome (anterior pituitary haemorrhage)
 - Cobras - neurotoxic paralysis and/or skin damage
 - Green pit vipers - coagulopathy, skin damage
 - potential diagnostic confusion with Russell's viper bite
 - Kraits - neurotoxic paralysis, possibly systemic myolysis





Chen Au Peh

Afzal Mahmood

Renal Unit, Yangon General Hospital









Myanmar Snakebite Project

- **What are the current issues affecting outcome for snakebite patients?**
- Inadequate training of health staff in snakebite management
- Inappropriate resourcing of peripheral levels of the health system
 - Can cause loss of community confidence, increased bite-to-needle time
- Inability to produce enough antivenom locally
 - Flow on effect is increasing use of Indian antivenom which is far less effective



Myanmar Snakebite Project

- We were approached by the Myanmar government to help solve their snakebite problem, starting with antivenom production
- We have successfully applied for Australian Government (DFAT) funding to tackle the snakebite problem in Myanmar
- Foreign aid funding granted in late 2014, running through till 2018 (~\$4 million)
- Project managed through the University of Adelaide
 - Project executive
 - Dr. Chen Au Peh (RAH - renal physician)
 - Prof. Julian White AM (WCH - clinical toxinologist)
 - Dr. Afzal Mahmood (UniAdelaide - public health physician)



Myanmar Snakebite Project

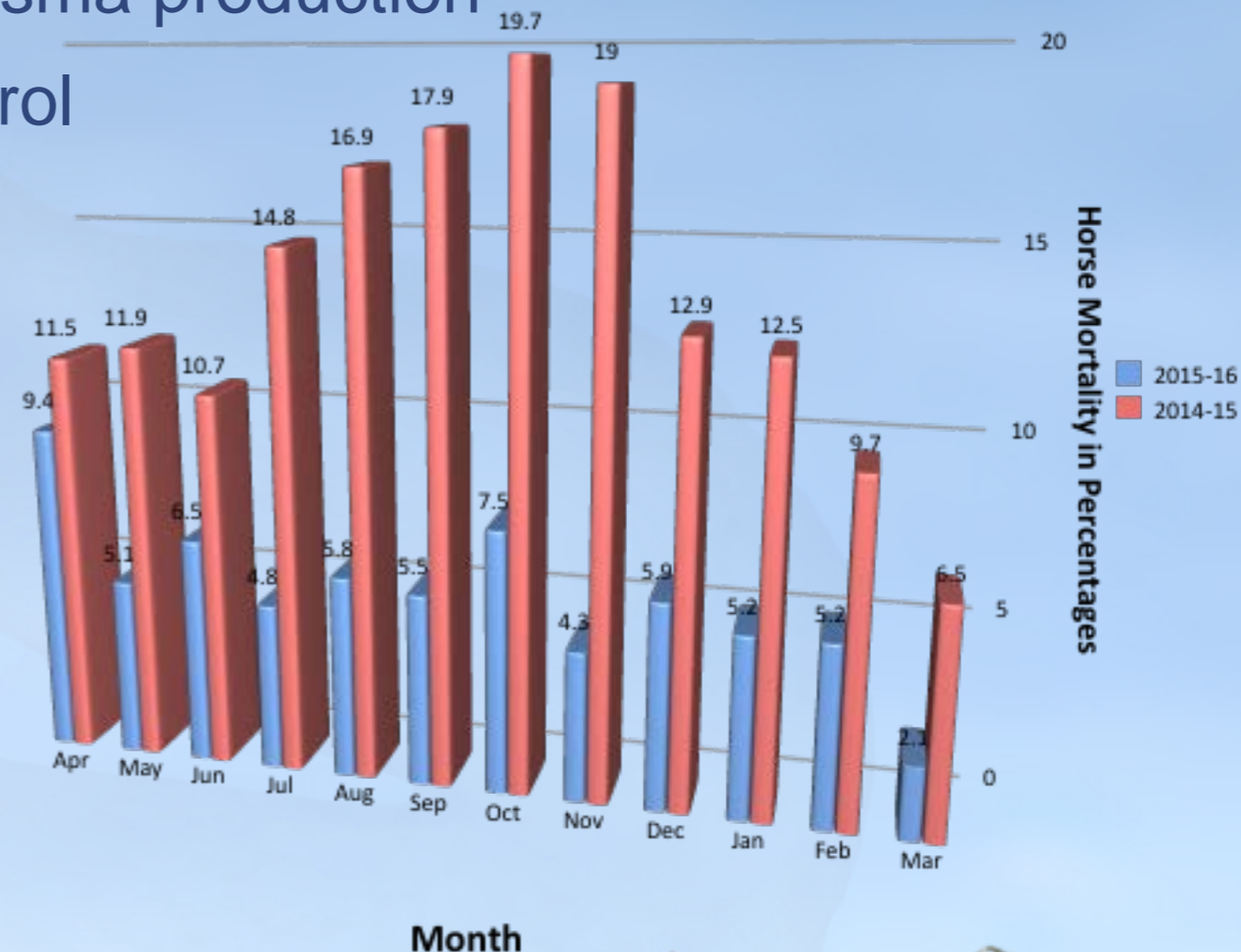
- **The Project in outline**
 - The Project central aim is to improve outcomes for snakebite patients throughout Myanmar
 - Our approach is holistic
 - There are 3 Project focus areas
 - Improve the quantity and quality and sustainability of Burmese antivenom production and to achieve full self-sufficiency
 - Improve the distribution and availability of antivenom to all those in need
 - Improve the management of snakebite from the village level through to major hospitals



Myanmar Snakebite Project

- Improving antivenom production
- We noted 3 problem areas, each of which we are tackling
 - Poor snake husbandry & venom production
 - Poor horse husbandry & plasma production
 - Poor quality assurance control

Horse mortality expressed as % of total herd in that month



TRADE  MARK
Since 1957

TRADE  MARK
Since 1957

VIPER ANTIVENOM

10 mL x 2 vials

One vial contains 10 mL of concentrated and purified enzyme - refined globulin of equine origin. Effective against the venom of Russell's Viper (*Daboia siamensis*).

No. (1) Pharmaceutical Factory (Yangon)

TRADE  MARK
Since 1957

TRADE  MARK
Since 1957

COBRA ANTIVENOM

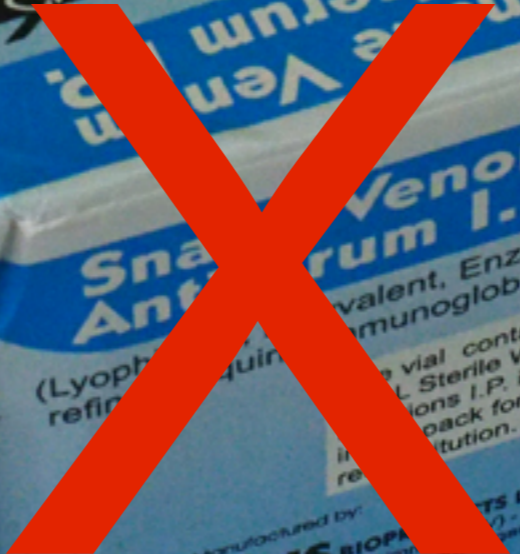
(Liquid)

10 mL x 2 vials

One vial contains 10 mL of concentrated and purified enzyme - refined globulin of equine origin. Effective against COBRA (*Naja Kaouthia*) bite.

Pharmaceutical Factory (Yangon)

REG.: R1608L0212
LOT: A 1001
MFG.: 27 1 2011
Exp.: 28 1 2011
Store Do not



Snake Venom Antiserum I.P.

(Lyophilized Equine Antivenom, Enzyme refined globulin)

One vial containing 10 mL Sterile Water For Injection I.P. is included in the pack for reconstitution.

Manufactured by: **VINS BIOPHARMACEUTICALS LIMITED**
Survey No: 117, Thimmar
Kothur (Mandal), Mahabubnagar (Dist.),
Andhra Pradesh, India.





In Summary

- **Snakebite is a significant occupational disease**
- **For local workers (farmers etc) a multi-pronged approach is needed**
- **For companies using imported workers**
 - Engage clinical toxinology experts to assist in determining
 - Risk profile
 - Prevention strategies including PPD
 - Training requirements and delivery
 - Care plans to best manage any cases that may arise
 - Health resource needs locally including antivenom





Questions?